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COMMENT AND NEWS

The following is a copy of a letter recently received by Miss Frances Mitchell, Secretary, Frederick W. Taylor Co-operators, Boxly, Highland Station, Philadelphia, Pa., from Mr. A. H. Paterson of London, England.

Social Welfare Association for London,
845 Salisbury House,
London Wall, E. C.
The Demobilization Committee.
November 1, 1916.

TO MISS FRANCES MITCHELL.

My dear Madam:

I beg to thank you sincerely for the "Tributes to Frederick Taylor," which I have read with great interest and pleasure.

I never had the honor of meeting him, but so great was his personality that it penetrated everything he wrote, and after studying his books and corresponding with him I became a Taylor disciple—not to say a devotee.

I am in a position now to know how wonderfully his ideals in Scientific Management are being recognized and even taken up by those who were its bitterest opponents a few years ago.

I had a striking instance of this in the change of attitude to be found in the pages of the Journal of the Fabian Society, *"The New Statesman"*—lately. A few months ago nothing too bitter could be said of the Taylor System. Today they practically recommend it, subject to there being proper safeguard against rate cutting and over production, overstrain.

I am not a Socialist by any means, but in this war time we English folk are drawing together upon all sorts of matters we used to fight to the death over—and I think it is one of the best tributes I can pay, in my humble way—to Taylor to say that even in England here among those who have hated employers and fought Scientific Management—he has conquered—or is conquering and "his soul is marching on"—triumphantly.

We feel it here particularly. It is our business to prepare for England's industrial future and to me—that is only possible by Taylor's ideal.

Yours sincerely,

(signed) A. H. PATERSON

SCIENTIFIC MANAGEMENT AND PROGRESS[1]

A DISCUSSION OF HOW FAR SCIENTIFIC MANAGEMENT IS COPING WITH PRESENT DAY INDUSTRIAL PROBLEMS AND WHAT IS THE OUTLOOK FOR THE FUTURE

BY HORACE B. DRURY[2]

The object of this paper is to explain what scientific management is; to note in what respects and how admirably it has fitted in with the industrial movements of the past thirty-five years; and then to search for any adjustments which the system may be asked to make if it is to be in full accord with the world of to-morrow. The scientific management which we are to consider this morning originated in the eighties. It was the answer, however, to industrial conditions which began to take definite shape soon after the close of our Civil War. The million soldiers who had been engaged on the northern side in that great struggle were, after their release, a great factor in peopling the agricultural west, and swelling the labor force of a manufacturing east. More important, five millions of immigrants flocked to the United States during the two decades 1860 to 1880, and another five millions in the single decade 1880-1890. This occupation of our public domain closed the frontier safety valve for turbulent or ambitious spirits, and brought the east, for the first time in its history, face to face with a serious labor problem.

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[1] An address given before the first Congress of Human Engineering, held under the auspices of the Ohio State University College of Engineering, October 6-8, 1916.

[2] Ohio State University, Columbus, Ohio.

The manufacturing industries into which the nation's surplus energy then turned had, before the middle of the century, been scarcely a promise. But by 1870, the number of wage earners had already increased from less than one million to more than two millions. By 1890, the new army had reached a total of four and a quarter millions; while the capital invested had grown from scarcely more than a half billion in 1850 to six and one-half billions in 1890. That is, less than one-twelfth of the capital invested in manufactures in 1890 had originated earlier than 1850. The two periods of great gain were the Civil War decade, and, more especially, the eighties. From 1880 to 1890, the number of wage earners in this country increased by one and a half millions, a growth twice as great as in any preceding decade, and fifty per cent greater than that which was to mark the nineties. The gain in capital during the eighties was three and three quarters billion dollars, or more than three times as great as in any preceding decade, and greater by about half a billion than the advance that was to be made between 1890 and 1900.

Even more phenomenal and significant than the expansion of manufacturing was that revolution in method known as the introduction of large scale production. Government reports and general opinion unite in placing the date for this transformation at about 1880. In the iron and steel industry the movement was well under way in the seventies, but in a greater number of industries the apex was reached in the eighties. Neither before nor after this period was there anything like as rapid a swing towards concentration, perhaps not even after 1900. It is remembered that the first trusts were also formed at this time, the Standard Oil Trust in 1879, and the first sugar and whisky trusts in 1887. In short, for the first time in American history it had now become common for large numbers of workmen to be employed under one management.

Another aspect of industry, significant in its bearings upon the origin of scientific management, was the new foreign element employed in the shops. The year 1882 was to mark the flood tide of a great wave of immigration, the 789,000 who came in that year setting a record which had never before been rivaled, and which was not again to be equaled for twenty years. Very nearly one-third of all the persons engaged in manufacturing, mechanical, and mining pursuits were already in 1880 natives of foreign countries, with the greatest immigration yet to come. The foreigners were mostly unskilled laborers, occupying the lower places in the industrial scheme, and that rapid shift in the source of immigration from northwestern to southeastern Europe, later to be so noticeable, had already begun.

It is seen, in short, that by 1880 or shortly after, most of the industrial problems of our time were on hand, and in that initial period when they were the most likely to do mischief, and to excite alarm. The rapid elimination of the frontier, which was to be practically complete before the end of the decade, was already beginning to confine ambitious workmen to subordinate positions in the east. The rapid increase in the size of many industrial plants was separating the employer from his employees. The foreign third of the workmen, many of them newly arrived immigrants, were not capable of ready co-operation with their employers, even had other conditions been favorable.

The resultant of these new forces was, on the one hand, the beginning of the modern labor movement. Prior to the Civil War, there had been in this country no union movement of other than transitory importance. Unions began to become influential in the latter part of the Civil War period, and, barring a few years of depression following the crisis of 1873, their membership steadily increased in numbers and influence. Especially after 1878 a period of growth set in, many of the unions finally merging themselves in the Knights of Labor, which by 1886 claimed 600,000 members. The first strikes of national importance which the country had ever had were the violent and widespread railroad strikes of 1877. During the eighties the losses arising from strikes increased rapidly, reaching a climax in 1886. The few years prior to 1886 constituted, indeed, the greatest strike period in our history. Since 1886, the number of strikes has not kept pace with the growth of population, much less with the growth of industry. But more important than the strikes of this period was the chronic disloyalty and inefficiency which marked the daily activity of thousands of workmen. The lack of contact and sympathy between employer and employee had weakened and perverted the entire industrial system. Limitation of output, soldiering, carelessness, these were the first fruits of the new large scale employment, and they constituted a problem which caused worry on all sides.

The other great development of the period, but one which was not to be at first so noticeable, was the creation of scientific management. The system which now bears this name started as the personal reaction of the late Dr. Frederick Winslow Taylor to the above described labor spirit. Taylor was born of upper-class American stock five years before the outbreak of the Civil War. As a boy he had been educated in France, Germany, and Italy, and prepared to enter Harvard. Trouble with his eyes, however, prevented his continuance in college, and we find him during four years of his youth working out apprenticeships in a small Philadelphia shop as pattern maker and machinist. He entered one of the new large scale establishments, the Midvale Steel Company, as a laborer in 1878. From laborer he successively rose through the positions of clerk, journeyman machinist, gang boss, foreman, and chief draughtsman until he finally became chief engineer. It was when he became gang boss in 1880 that Taylor first determined to discover by scientific methods how long it should take each man to do each given piece of work; and it was in the fall of 1882, shortly after he had been elevated to the position of foreman, that he started to put the first features of scientific management into operation.

Before proceeding to an analysis of the principles of scientific management, let us first perfect our idea of Taylor by noting the other outstanding features of his life. In 1889, Taylor left the Midvale Steel Company in order to apply his ideas in a wider field. For three years he served a corporation operating large pulp mills in Maine, and then he attempted in various parts of the country a reorganization of industrial plants. This involved a variety of manufacturing, structural, and engineering work. His most celebrated personal undertakings were in connection with the plant of the Bethlehem Steel Company between 1898 and 1901. By 1901, Taylor had acquired a fortune which enabled him to retire from work for pay.

Dr. Taylor took the degree of mechanical engineer from Stevens Institute of Technology in 1883. In 1906, he served as President of the American Society of Mechanical Engineers. Besides his writings on management, he contributed to this society several notable papers on mechanical subjects, of which the greatest was his president's address in 1906 on "The Art of Cutting Metals." He took out about one hundred patents, his greatest invention being the discovery between 1898 and 1900, jointly with Mr. Maunsel White, of the Taylor-White high-speed steel. He was honored by the University of Pennsylvania with the degree of Doctor of Science in 1906, and was claimed as a friend by some of the highest officers of the navy, and by prominent engineers, manufacturers, and public men. Dr. Taylor died March 21, 1915.

To return now to the youthful Taylor of 1880, and his beginnings of scientific management. Taylor's observation had been that his neighbors in the Midvale shops failed to produce more than about one-third of a good day's work. Wages were on a piece-work basis, and the men were afraid to let the management guess how large a product they could really turn out because it might mean a cut. This tendency on the part of the workmen had resulted in a war between Taylor, the gang-boss, who was trying to induce the men to work faster, and the workmen under him, who were determined that by fair means or foul they would avoid working faster. As a result of this struggle, life to Taylor had become hardly worth living. Accordingly, shortly after he was given the greater authority of foreman, he determined to work out some system of management by which the interests of the workmen and of the management would be made the same.

The basic principle of the scientific management which he evolved is that the management shall determine very carefully just how much work a man ought to do, and on the other hand, that the man should then be offered a premium sufficient to induce him to perform the task. From this simple idea all of scientific management has grown, and to this idea most of it may still be reduced. The classic illustration of the scientific determination of the task was Taylor's twenty-six year study in the field of cutting metals. The regular method is to make a study of every element entering into a job; and then add together the times which it takes to perform the necessary elements, to find the time required to perform the entire job. A margin of safety is ordinarily left, to cover delays. The stop watch is the instrument ordinarily used in making the time studies.

The methods by which men are induced to perform the task are Taylor's differential rate—and, among later developments, Gantt's task and bonus system, and other special bonus or premium systems. The amount of reward to the workmen varies considerably, but most often amounts to twenty or thirty per cent higher wages than they have been accustomed to earn. Such a reward is usually sufficient to induce workmen to attain the tasks laid out for them, and the tasks can often be so set as to increase production one hundred per cent or more.

It is not to be supposed, however, that scientific management is based upon the overspeeding of workmen. The goal is reached largely through a more perfect utilization of machinery and tools, the elimination of actual idleness or wasted motions on the part of the men, the withdrawal from a job of operations that can more fittingly be performed some place else, and only to a very limited extent by means of speeding up. It is primarily the interest, the loyalty, the obedience of workmen that scientific management strives for; and for this obedience the management does not hesitate to pay a substantial price.

This method of inducing workmen to do their best constitutes historically, the most fundamental and essential aspect of scientific management. It is, however, by no means, the system's only feature. It was very early discovered that in order to set tasks properly the management had to learn a great deal about the work, and, when it knew a great deal about the work, it could commonly introduce improved methods of performing it. So planning rooms developed, motion studies were made, instruction cards drawn up, employees trained, tools and equipment standardized at high quality. Much of the increased output under scientific management springs from the methodical and exact way in which these features have been worked out. This second story of scientific management is today almost as important as the first.

A third notable characteristic of scientific management is what is known as functional foremanship. In order that the management might discharge creditably its greatly increased responsibility, it became necessary not only to increase its numerical strength, but to split up the duties of management among as many as eight different authorities. These are given such names as gang boss, speed boss, inspector, repair boss, order of work or route clerk, instruction card clerk, time and cost clerk, and shop disciplinarian.

A capacity in scientific management and its leaders to expand Taylor's original program and adjust itself to the needs of industry appeared very early. As the system was first thought out and practiced by Dr. Taylor it had a certain inflexibility amounting almost to impracticability. And especially was this true of the methods which he used in pushing the system. It is no secret that Dr. Taylor was not himself very much of a manager. Persistence and genius he had without end. But he was not an adept at judging men, nor tactful or conciliatory in his method of approach. Even for his friends he was a hard taskmaster, and his entrance into a new plant would stir things up from the bottom. He insisted, too, that reorganization be thoroughgoing and complete, according to what often seemed a preconceived notion.

These characteristics were partly due, doubtless, to the fact that Dr. Taylor himself had comparatively little experience with the introduction of his own system. Besides his deep interest in scientific management, Taylor gave a considerable portion of his time to other matters. He was an inventor of no mean ability, and took much pains with scientific investigations, as, for instance, that into the cutting of metals. Taylor did not work what most men would regard as a full day, but came late and went home early. And finally, he retired from active service in 1901, at the age of forty-five, fourteen years before his death, and scarcely twenty years after getting started seriously in work. No wonder that he did not accomplish everything, and that much was left to be developed by others.

Among the first friends of Taylor to improve upon his methods was Henry L. Gantt. Gantt is what Taylor never was—a skillful manager. He has carried through such undertakings as the reorganization of the Remington Typewriter Company, the concern which makes Remington, Monarch, and Smith-Premier typewriters, and many other concerns almost equally large and well-known. Gantt gets along well with the people whom he has to manage, bends his course to suit the exigencies of a situation, and aims at important practical savings. He regards every factory as a law unto itself. His scientific management is not one mould, which all factory organizations must be warped to fit; but, as he sees it, there are as many distinct scientific managements as there are different shops. Gantt's work, however, is only one illustration of what has been done to a greater or less degree by all the close friends and followers of Taylor. Scientific management is the joint product of many minds, working under the inspiration of a dominant personality.

The results obtained under scientific management have been such as to attract the attention of a wide public, and to win support in many and important quarters. As before indicated, it seems probable that on many kinds of work, the increased output of employees runs well up to one hundred per cent; while there are instances of increases of two hundred per cent and more. In other instances, of course, the gains are much more moderate. The prestige of the system among engineers and with the public has been heightened by the support of men like Henry R. Towne, James M. Dodge, and Frederick W. Taylor, all past presidents of the American Society of Mechanical Engineers, and Louis D. Brandeis, Justice of the Supreme Court; and by the space given to discussions of the system in leading technical and popular journals and in the writings of leading thinkers. Its standing in the manufacturing world has been assured by its adoption in such representative plants as that of the Pullman Company, the Yale & Towne Manufacturing Company, the Union Typewriter Company, the Remington Arms Company, the Government arsenals, and, in the old days, the Bethlehem Steel Company and the Santa Fé Railway. Some tens of thousands of workmen are already working under it in a fairly complete form; while it is safe to say that the influence of the system has spread in one way or another into almost all the industrial plants of the country.

In spite of this rapid growth in favor, there nevertheless remain some very powerful and persistent antagonists. When Charles M. Schwab obtained control of the Bethlehem Steel Company in 1901, this company's position as a center of scientific management activity, which up to that had been without a parallel, was promptly destroyed. While much of the system was in fact retained, all allegiance to it was emphatically disowned. It is not surprising that in this and numerous other places scientific management has met with opposition on the part of employers. The idea of one man does not take precedence over the ideas of a thousand other men without meeting constant challenge, especially when it is the province of the other thousand to decide the issue.

The only opposition which may be regarded as really serious, however, is the opposition of organized labor. The reports of the American Federation of Labor show that their first period of rapid growth occurred following 1898 and prior to 1904. In these years the membership of the Federation leaped by one great bound from 275,000 in 1898 to 1,675,000 in 1904. But following 1904, for a period of five years the Federation lost ground, so that in 1909 the membership was about one-eighth less than it had been in 1904. This check seems to have been imposed partly by a hostile attitude assumed by the courts, but more especially by a policy of antagonism on the part of great corporations and powerful employers' associations. Professor Commons, writing in 1908, declared that "the unions have practically disappeared from the trusts, and are disappearing from the large corporations as they grow large enough to specialize minutely their labor."[1] Naturally the unions began to give their attention to the matter of the obstructive forces, and to form plans for defending themselves. In the words of Professor Carlton, writing in 1910-11, "bitter opposition and adverse judicial decisions may force even conservative unions to adopt other methods and policies than those utilized during the last two or three decades."[2]

It was just at this juncture that for the first time a blaze of publicity was thrown around scientific management. In the fall of 1910 and the spring of 1911, the now Justice Brandeis conducted before the Interstate Commerce Commission his famous defence of the eastern shippers against a proposed advance of railroad rates. Brandeis' main argument was that the railroads would not need to increase rates if they would introduce scientific management. In a few weeks, the entire country was inquiring as to what this scientific management was, and organized labor was confronted by the necessity of taking a stand with reference to the new development.

The labor leaders very quickly and very properly decided that the growth of scientific management presented a danger to their organization. The main reason why we have labor unions as at present organized is because of the existence of laboring classes, whose manner of life, education, and interests are enough at variance with those of the employing classes, so that the former crave a special protection. Were there no sharp divergence of interest or sympathy, it would not be necessary to build up class solidarity, to insist on organized action, or to extend systematic aid and protection to the otherwise isolated worker.

It was, however, a postulate laid down by Dr. Taylor that there is no natural clash between employer and employee. Both, he would say, are interested primarily in greater production. Taylor believed that he had devised a system that would substitute a scientific for a contentious division of the product. Employers should not be organized in employers' associations and workmen in labor organizations for the purpose of battle. But all should be partners, work in harmony, and settle their relationships according to scientific truth. Recognizing no divergence of interest, Taylor, therefore, would have the management itself look out for the laboring man.

To Taylor and his followers, moreover, the spirit of the unions seemed unfavorable to industrial progress. Taylor was interested in greater production, in introducing better methods, in progress; whereas the union membership is made up largely of that middle class of people who are conservative, suspicious of change, and somewhat hard to reason with. In particular, the workingman has been suspicious of the introduction of machinery, of increases in output, of speeding up. Partly just, partly unjust, these suspicions have been; but they were a big factor in preventing Taylor and the unions from working as partners in a common cause.

The outcome in scientific management plants of this unfavorable sentiment towards trade unions has been that the latter have almost invariably had the worst of it. Taylor testified before the Industrial Relations Commission in 1914 that members of labor unions had left in large numbers at Midvale, Bethlehem, Tabor, Link-Belt, and to a certain extent in every company where he had ever been. It is easy to see why unions could not put up much of a fight in shops operating under such a system. In so far as it centralizes skill, scientific management takes from the workmen that bond of common craft knowledge, which tends to make brothers of the men engaged in a trade. Since it pays on an individual or efficiency basis, and promotes the more able men to fill positions as functional foremen, scientific management appeals to personal ambition, rather than to class solidarity, and makes less sharp the line of cleavage between management and men. As it voluntarily pays higher wages than the men could win through force, scientific management weakens the main motive for organization, and makes the employees hesitate to compromise themselves with their employers. In short, scientific management did not need to lay itself out to any noticeable extent in order practically to rid itself of trade union connection.

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[1] American Journal of Sociology, Vol. 13, p. 759.

[2] History and Problems of Organized Labor, p. 75.

Scientific management was not extensive enough in 1904-1909 to have been any important factor in the temporary checking of trade unionism which then occurred. Its spirit, however, was one with the spirit of the great corporations which were making themselves independent of unions. Its spirit was the very essence of centralized power, of managerial self-sufficiency, of workingman subordination. Against its winning persuasiveness the outside labor union could hurl itself in vain.

It was not to the workingman, however, that organized labor was to make its appeal. A million or two men are not sufficient to control the industrial world. But a million or two voters are not to be neglected. It was in the political arena, therefore, that organized labor was to show its greatest strength; and it was to Congress that labor went for aid in its contention with scientific management.

Congress happened to have a very direct concern in scientific management, inasmuch as the system was being introduced in the government arsenals, and was later to be proposed for other departments,—as the post office. On its floors, therefore, ever since 1911, bills and resolutions in great number have been introduced calling for investigations or prohibiting the continuance of the system. In particular, riders attached funds for the making of time studies or the payment of bonuses.

The first victory for labor was won in March, 1915, when the House forced the Senate's unwilling consent to provisions in both the army and navy appropriation bills forbidding the use of funds for either of the purposes just mentioned. The shaft failed to hit the mark, though, as it developed that the condemned devices were financed through the fortifications appropriation, and not through the army or navy appropriations. In the 1915-16 session of Congress the fight was therefore taken up again with renewed vigor, and riders withholding funds for time studies and bonuses were attached to the fortifications, army, navy, post office, and sundry civil appropriation bills. All these measures went into operation last July, and had the important effect of suspending bonus payments at the Watertown arsenal, the one point where the Government had extensively introduced scientific management, and also preventing, for the year at least, the installation of scientific management in the other branches of the federal service covered by the bills. A yet more substantial victory, however, is the goal of labor. The Tavenner Bill, introduced and fought over last session, and on the calendar for consideration next session, would permanently forbid by statute the use of time-measuring devices on, or the payment of bonuses to, any employee of the United States Government, declaring any such act a misdemeanor punishable by fine or imprisonment. The Van Dyke Bill, which now rests in the hands of the Committee on Post Offices and Post Roads, contains similar provisions, but applies to the post office only.

Such tactics on the part of the labor men, and the response being made by Congress, seem to be, and, we believe, are, both unjust and a menace to the future progress of the country. Yet it is not hard to see how the situation arose; nor is it impossible to find weaknesses in scientific management itself which invited such attack. It is true that the arguments presented to Congress were pitifully weak. The two counts against scientific management are first that it involves overwork; and second, that to have one's motions timed by a stop watch is degrading. But neither government commission nor critical private investigator has been able to unearth any extended instances of overwork. Even so watchful a critic as the late Professor Hoxie testified that he had "a strong impression that scientific management workers, in general, are not overspeeded."[1] And as for the stop watch, the real objection, surely, cannot be to the thing itself; but only to some peril that it is felt will grow out of it. But what this peril is, is usually not very clearly indicated.

Yet underneath these surface arguments, there exists a real clash involving fundamental principles. We are called to witness a struggle, which it would be folly to try to evade, and which is bound to continue until both scientific management itself, and the general character of our national life will have been profoundly affected. Taylor himself never regarded scientific management as perfect or complete. We may, therefore, without prejudice to him, or his work, inquire into those aspects of his system which are at the real root of the present controversy, and which the world of to-morrow probably will not accept, save in modified form.

In the first place, and of most importance, the confidence which the system places in the unselfishness and public spirit of the management is excessive. Not that managements may not, and have not, in notable instances, possessed great virtue. But there is no reason to suppose that those particular organizations known as industrial corporations can be made so universally and fundamentally superior to city councils, labor unions, churches, chambers of commerce, *etc.*, that they alone of all organizations should be allowed to go their way unchecked, unwatched, possessing the complete and unchallenged confidence of the public, of labor, of the government. Taylor was eminently right in urging managements to assume this high character; and one of the most hopeful signs of the time is the noble way in which they have responded. But should not the pre-eminence which any management enjoys in this respect rest upon the voluntary recognition of its achievements and character, rather than upon a pious insistence that organizations of employees or of outsiders must refrain from passing an opinion upon matters so out of their sphere? That would not be a popular attitude if assumed by the president of the United States. Even a bank cashier, though selected for his integrity, does not refuse to have his accounts examined.

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[1] **Scientific Management and Labor, p. 92.**

In the second place, the principle of Dr. Taylor that the management should acquire and sum up in itself *all* the skill and science required in industry is an ideal that is likely to fall increasingly short of realization. In no shop has scientific management yet succeeded in placing *all* of the work on the task basis, though sometimes this end is fairly closely approached. Not even in the best and most widely praised shops is the time allowed for the work so scientifically correct, that all jobs are equally exacting, and that the men take no thought of limiting their output a little on the easier jobs. Yet time study based on existing methods is the least serious of the tasks which scientific management has obligated itself to accomplish. How likely, then, is it that when it comes to devising entirely new methods of work, the small group of men in a shop known as the management will be able themselves to hit upon all of the best features. As industry increases in complexity, and as the laboring man grows in education and intelligence, we may be sure that a time will come when the laboring man will know more about many things than the management possibly can. Hence this system's vision of an industry animated almost altogether from the top may turn out to be considerably distorted.

In the third place, scientific management has relied too largely upon the daily wage as an all-powerful link binding a man with ties of loyalty to his employer. Pay is undoubtedly the one most important relationship that needs careful treatment in order to insure the loyalty of employees. But it is by no means the only factor. Much of the best work of the world in science, in government, in art has been done for small pay. Even in business the British man of affairs is apt to be as much influenced by the hope of a peerage, as by that of large profits; the American financier as much by the love of playing the game as by the pleasure of disposing of the proceeds. It is to be hoped, therefore, that managers may acquire greater skill in analyzing human motives, and be able to control various additional forces that lead men to labor.

In the fourth place, scientific management has given only superficial attention to the important topic of fatigue.

There is a widespread impression that, in addition to what has already been noted, scientific management has been yet more careless in its estimate of the worth of workmen; that it has ignored much of their humanity, and consciously and inexcusably been indifferent to their welfare. There is much gross exaggeration in this. Dr. Taylor once declared: "The interest of every man who is in any way engaged in scientific management, in the introduction of the principles of scientific management, must be first the welfare of the working man. That must be the object. It is inconceivable that a man should devote his time and his life to this sort of thing for the sake of making more money for a whole lot of manufacturers." As far as Dr. Taylor's own actions were concerned, his life put the stamp of sincerity upon these words. And it is equally true of most of the other men active in introducing scientific management that they have been kindly and even magnanimously disposed towards labor.

Yet, as Mr. Robert G. Valentine has well said, many of the impressions which Taylor conveyed in describing his ideas did violence to his real spirit. He used to speak, for instance, of pig-iron handlers at Bethlehem as having the mentality of the ox; and designate whole classes of workmen as being analagous to the dray horse, or the grocery-wagon horse; while others were of the trotter class. Such language did Dr. Taylor and his cause immeasurable harm. Yet he had no thought of insult. In later life he would in like manner swear before classes at Harvard; though probably he had genuine respect both for the institution and the students. It was merely his picturesque and forceful mode of expression, schooled as he was in the ways of the shop.

Possibly, however, it should be put down as one of the weaknesses of scientific management that it takes workmen too much as they are, forgetting that a larger social program might conceivably make of them quite different and better men.

While we therefore believe that certain aspects of scientific management are not ideal, this is not to be regarded as an adverse criticism of Dr. Taylor, or his work. If only we recall the conditions under which scientific management was originated, we are compelled to forgive and even praise the course which Taylor followed.

Take workmen as Taylor knew them about 1880, and a paternalistic system was eminently fitting.

Strangers in a new country, ignorant of its institutions, crude and stolid in intellectual development, they were not fit for self government. The employers of this time, moreover, had to fill a more responsible and independent position in the nation's industry than ever before or since. It was in the initial stages of a new and large-scale production, when resources were being exploited, new fields of manufacture opened up, foreign markets conquered. In such a period of transition and construction, the business enterpriser is the all important director of the country's activities. Even able employees have little higher responsibility. The great questions to be decided are whether an industry should be created, or perhaps discontinued; whether the people employed should be skilled or unskilled, or whether machinery should displace labor. On such matters the employees concerned cannot, of course, pass unbiassed judgment. What industry needed was a pliable working class, who would fit in readily with the shifting programs of capitalist and enterpriser. Lucky the workman who could secure a benevolent employer. And lucky the manufacturer who could secure humble, foreign workmen, unbound by tradition, and not self-assertive.

Likewise, when we remember Taylor's situation, we cannot blame him for refusing to allow much place for the initiative of workmen. Many of the workmen were of the class just described; and most of the balance lacked that specific training which might otherwise have made their co-operation of value. The graduates of the new engineering education were in the eighties but a thin leaven in a great world; while it was to be many years before the schools were to plan an industrial education for the masses. But even had they been trained, the workmen of Taylor's time were filled with a suspicion of efficiency that made them more interested in limiting output than in increasing it, in blocking the introduction of machinery and improved methods rather than in assisting in this work. These conditions, we believe, account for and excuse the rigid control, the too-sharp separation of planning from performing, and the insistence upon a rather blind obedience to directions which has characterized scientific management.

Again, the earlier relations which had prevailed between employers and employees may be cited as an explanation of Taylor's failure to develop any thoroughly socialized system of drawing out loyalty. Scientific management was started in order to displace a warfare which had developed between management and men. And in combatting and overcoming this warfare, the system necessarily took a part of its own character from it. The spirit of the men had so long been steeped in antagonism, that there was practically only one appeal that could be made to them. The central principle in the science of management therefore became the forging of a very tight and somewhat mechanical grip upon employees, through a skillful regulation of their pay. It is, however, to the great credit of Taylor and his associates that they progressively gave more and more attention to the spirit of the shop, and dwelt less heavily upon the earlier mechanical devices.

This justification, which we have just been making, of the attitude assumed by scientific management in times past, does not, however, affect our judgment that, in the future a more democratic control and a more widely diffused responsibility will have to prevail. Certain basic changes now taking place in our social and economic institutions will eventually render obsolete many practices once thought necessary.

The chief of these changes, and the one which will have the greatest import for scientific management, will be a transformation in the working population. Any group of people who presume to outline a program for the future which does not take into account the rise of an employee class quite different in character from that which formerly filled our shops will be making a grave mistake. The whole trend of our modern spirit is in the direction of a sharp uplift of the mass of mankind. Our original human nature is going to blossom into a very different kind of manhood and womanhood under the greater opportunities which are now being thrown open.

The accomplishment of such a transformation is the goal of the progressive political movement, which gave up its independent life only because it had won control of one, if not both, political parties. The elevation of the ordinary man is the program of the modern social movement,—which dominates the public schools, the churches, the universities, and the Y. M. C. A., and finds its expression throughout the literature of the time. It is this spirit which has borne fruit in the reform of taxation, in the fight against privilege, in the founding of all sorts of civic institutions, but first and pre-eminently in the expansion of popular education.

We must think of the employee of tomorrow, then, as the graduate of a technical or trade school, if not of a university. We must think of him as a man or woman of culture, of intellectual power, of initiative, a person nourished from youth in the exercise of freedom and judgment. Trained in science, and polished by a varied experience, he will be no more like Taylor's pig-iron handlers, or the typical workman of yesterday than vapor is like a solid or a liquid. In short, the human material with which the science of management purports to deal will have been changed. And when the subject matter of a science changes so must the science also.

In keeping with this new environment, we must therefore anticipate a new scientific management. It will have to be somewhat different, first of all, in method. The ideal of securing individual efficiency through restraint and command will have to give way, some time, before the more efficient program of opening the way for individual self-expression. Not that no one should lay out tasks for others; or that vast numbers of workers should not make their methods conform closely to one most efficient standard. An opera singer may fittingly follow the directions of her managers as to routes of travel and concert dates; a great engineer or builder may conform in detail to specifications drawn up by others. The point is that, while an individual does many things that others plan, he should have some things to plan himself. That is what a man is for. To neglect to utilize and develop the unique originating, choosing, and adapting power with which every individual is more or less endowed is to waste the earth's greatest resource for which the growing complexity of industry and the arts will ever make greater demands. Besides, to deprive men of the opportunity to create is inhuman, degrading, and destructive for the individual, the ruination of pleasure in work, of romance and achievement in life.

Scientific management will also have to clothe itself in a somewhat different spirit. That age-long impulse towards democracy that first humbled kings, and later liberated and enfranchised serfs, is still in full swing; and can stop short of nothing but complete social and individual emancipation. The storm that has risen around scientific management has largely grown out of a notion that the system was trying to block this movement. But we need not fear that such an interpretation of the system can be maintained. The age that rushes to give the vote to women on this side of the water, and hesitates in time of national peril to conscript labor on the other side will not tolerate any system of management which does not give praise to the man who works, thrust upon him respect and opportunity, give heed to his sentiments, acknowledge his fellowship, ask for his co-operation. Whatever smacks of any other feeling in scientific management is a product of the past, and like it will have to be left behind.

The fathers of our revolutionary period, it is worth while to remember, were not greatly injured by the policies of Great Britain. For years after the revolution they continued to buy mostly from England, and to use much the same trade routes as it had been the policy of the mother country to prescribe. Their burden of taxation was only increased by independence, their protection diminished. But the founders of our nation would not tolerate the shadow of subordination to Great Britain. It was the spirit rather than the acts of the imperial government which inflamed American opinion and led to the longest and most fateful struggle in our history. So let us take heed of the continuation of independent spirit among the masses, even the immigrant masses of today. Let us be thankful that the spirit of our country's past is not dead, and let us bend before it, work with it, utilize it. Not money alone, but self-respect, responsibility, partnership, is the birthright of American labor. Not only the reality of these things, but out and out, thoroughgoing recognition must be maintained.

Now these things have not been overlooked altogether by Dr. Taylor's associates. The most interesting development in the field of scientific management at present is the start that is being made in the direction of such Twentieth Century ideals. The recognition of the humanity of employees, of the importance of the social life of an industrial organization, is possibly nowhere more complete than in the Clothcraft Shops of the Joseph & Feiss Company, Cleveland. In a paper on "Personal Relationship as a Basis of Scientific Management," written by Richard A. Feiss, the manager, as well as in various descriptions of the Clothcraft Shops given by other persons, it would appear that we have here an unusual example of a socialized, industrial undertaking. Among the institutions of the factory are a choral club, with membership upwards of two hundred, a factory orchestra, and leagues for baseball, quoits, captain ball, and other sports. During the winter, the different divisions of the shops give parties, at which entertainment is furnished by the employees and their families. Members of the firm, as well as all others, attend these parties, and a democratic spirit prevails. On regular days dancing is a feature in the woman's recreation room, and there are dining rooms where every employee has his own seat.

One of the highest officials of the Joseph & Feiss Company is their Employment and Service Director. It is, among other things, the duty of this lady and her department to develop an organization spirit, and to facilitate among the employees the development of a democratic expression of personal and public opinion. The department itself comes in contact every day with about one-fifth of the Clothcraft employees; and all cases where direct conference with the management would be beneficial are immediately referred to it. The interest of the firm in its employees extends also to their families and their homes, as the Employment and Service Department has instituted the practice of home calls. One effect of these visits and of the company's careful medical advice has been the practical elimination of tuberculosis. A net effect of the entire social and individual program has been the development of an *esprit de corps* which has been remarked by all observers.

The road to advancement in these shops, moreover, is not only open to all employees, but every possible aid and encouragement is given. Practically all positions in the organization, both clerical and executive, are filled by those whose abilities have raised them from the ranks. The plant has reading rooms, and a branch of the city public library. Information is furnished employees concerning special classes in the schools. The management believes in encouraging to the utmost individual education and development.

The significant thing about the Clothcraft Shops, however, is not these things taken by themselves, but the fact that the shops are operated under scientific management, the features described being regarded not only as consistent with, but essential to, a thoroughgoing application of Taylor's principles.

Another plant widely regarded as characterized by an advanced spirit in the place accorded to the men, and also for many years in sympathy with the Taylor movement, is the German-American Button Company, of Rochester, headed by Mr. Henry T. Noyes. Mr. Noyes has a wide vision of the change in spirit that is taking place in industry, and regards the old way as a survival of feudalistic class distinctions. In particular, the distinction between office and factory is a relic of the old disdain with which a leisure class formerly regarded the laboring class. Conditions as to hours of work and treatment in the German-American Button Company are identical for office and factory. Even in ringing in and out on coming to and leaving work, officers, office, and factory have followed the same routine.

Mr. Noyes counts on his employees' taking part in the life of the business through regular department and other meetings. Practically all the foremen have risen from the ranks. None of these features are found to be inconsistent with the use of the stop watch. Nor has the latter device prevented the development of the most cordial relations between management and men. Even the Italians of the second generation are welcomed into the fellowship as full Americans.

These illustrations are advanced not because the shops described are necessarily superior to anything that might be reviewed outside of scientific management; but because the honor and attention which great numbers of the followers of Taylor are giving to this kind of thing shows in which direction the tide of scientific management is setting. We do not say that the spirit in these shops is perfect, or that they are an exact prototype of what will later be universal. On the contrary, we are very doubtful about some of their policies. But do they not in fact show that scientific management is striding towards a more humanized and socialized system, a real science of human relations?

The last point which we wish to make is the important one that, in spite of any elements in scientific management which the future may show to have been ephemeral, there is in the original spirit of Taylor, a principle or two that is valid not only for his time but for all time. The changes taking place and to take place in the outer aspects of scientific management have not and will not carry it away from these principles. They may be given as two in number: first, science in industry; and second, harmony in industrial relations.

The science at which Dr. Taylor so skillfully worked was, as he himself used to insist, never complete. With every change in social institutions, the human side of it will have to be recast; with every advance in invention and industrial technique, the mechanical side of it will tend to become obsolete. Yet the vision of a science in industry has taken possession of some dozen of the leaders of American industry, and by them is being passed on to numerous factories, until it is to be hoped that it will reach ultimately the humblest of American workingmen.

The harmony which Dr. Taylor tried to establish ignored several important forces, which his training had not permitted him to understand. His quest for harmony led through conflict, passion, and disappointment to death itself. Yet Taylor's vision will not be forgotten, nor will the effect of his effort be lost. In many factories the relations between employers and men have been ameliorated. And his ideal to consolidate and unify the conduct of American business will live.

Mr. George D. Babcock has defined scientific management as "that kind of management which conducts a business or affairs by standards established by facts or truths gained through systematic observation, experiment, or reasoning." Concretely put, this involves, first, the scientific laying out of tasks; second, a just system of rewards for those who successfully co-operate; third, the scientific study of methods; and fourth, the organization of all work according to a functionalized or specialized division of authority. The more one reflects over these principles, the more evident it becomes that the industry of the future will have to be built upon some such general basis.

It will be the task of human engineering to see that the standards set up under scientific management become increasingly more scientific, taking into account the real natures of both materials and men. It will be the task of public opinion to see that industry becomes progressively more vitalized and more democratic.

This paper will be read by title and discussed at the annual meeting. Members should familiarize themselves with its argument and be prepared to participate in the discussion.

SCIENTIFIC MANAGEMENT AND ITS RELATION TO THE HEALTH OF THE WORKER[1]

By Richard A. Feiss[2]

1. Scientific management, as the name suggests, applies the scientific method to all the activities of management. This means that the management assumes the responsibility for thorough investigation and procedure based on accurate knowledge. Not only are materials and equipment scientifically studied and methods for their use and up-keep established, but the human effort expended in their use must also be studied from the point of view of continuous upkeep. In fact, scientific management is the management of conservation. As such it must deal primarily with the conservation of human effort. This is true not only from the humanitarian point of view, but also from the economic. Taking the purely business aspect, there is nothing more profitable or more essential.

2. In considering conservation of human effort the steadying of employment is of the greatest importance. The loss both to the management and to the worker through the constant change of personnel one finds in the ordinary industrial organization, can hardly be conceived. It has often been estimated that the cost in dollars and cents of replacing an old employee by a new one amounts to anywhere from fifty to two hundred dollars. The loss to both the organization and the worker in effort, morale, and efficiency, while less tangible, is far more important. A manufacturing concern in Detroit, employing fifteen hundred men, employed some thirteen thousand men, or over eight hundred per cent of its total standing payroll from the spring of 1915 to the spring of 1916. A brass foundry in New England employing three thousand, employed during the first eight months eight thousand. The latter replacements would be at the rate of twelve thousand a year, or over four hundred per cent. A large rubber concern in Ohio employing over ten thousand men and women is said to have a labor turnover of one hundred fifty per cent. At the Clothcraft Shops of The Joseph & Feiss Company an attempt has been made to approach this subject from the point of view of scientific management. The percentage of replacements during 1915 was forty-eight per cent, and for the first nine months of 1916 was no greater. This result comes from a realization of the importance of conservation of human effort, and of the fact that employment is not a mere matter of hiring and firing but, from the scientific viewpoint, is a matter of hiring and keeping.

3. For the purpose of scientific employment The Joseph & Feiss Company have established an Employment and Service Department. The functions of this department are conducted from the point of view of keeping every position in the organization filled with fit men and women. The fitness of the worker involves primarily his health. It is apparent on the face of it that a worker under the handicap of even a minor ailment is going to suffer materially in his steadiness and efficiency. His health, therefore, must be conserved in the most scrupulous manner. For this purpose an adequate medical department is considered an essential part of the employment and service function. A medical examination is not only essential for the new employee but a periodical reexamination and follow-up are also an integral part of the work. In this way alone can the results of the work upon the health of the worker be properly checked up and a course consistent with the best health of each individual worker be followed. Some of the details of this work and its effect have been touched upon elsewhere. (*[1])

4. In connection with the health of the workers in industry, home conditions are of vital significance. No real educational or constructive work can be done without keeping this fact constantly in mind. The carrying of educational work into the home is of inestimable value. For a very capable description of this kind of work refer to an article entitled "The Relation of Home Conditions to Industrial Efficiency" (*[2]) by Mary B. Gilson, Superintendent of the Service and Employment Department of The Joseph & Feiss Company.

5. The poor health of a worker is commonly laid at the door of industry. Conditions contributing to the ill health of workers, however, are not inherent in industry, but are the result of unintelligent or unscientific management. While it is true that the conditions under which people work are responsible in some instances for ill health, a thorough investigation of the facts in each case would often disclose the ill health of the worker to be due entirely to personal habits or home conditions. It is common not only for the layman, but also for the physician to jump at conclusions in this matter. Physicians are often only too ready to lay the cause of an ailment to a man's work and to advise him, without any real investigation, to quit his job or not to work in a factory. It is very

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[1] A paper delivered before the American Public Health Association in Cincinnati, Ohio, October 25, 1916.

[2] General Manager, The Clothcraft Shops, The Joseph & Feiss Co., Cleveland, Ohio.

*[1] "Personal Relationship as a Basis of Scientific Management." A paper read by R. A. Feiss before the Society to Promote the Science of Management, Philadelphia, Pa. October 23, 1915.

*[2] Appearing in the Annals of the American Academy of Political and Social Science, Philadelphia, May, 1916. Publication No. 1009.

easy to make sweeping assertions as to factory work and to advise workers to leave their jobs on the slightest pretext of ill health, but professional men, above all, must realize not only the difference that exists between industries, but also between various establishments in any one industry. The giving up of a job, even temporarily, is a matter of very great moment to the worker, and we question the right of any one's assuming the responsibility of giving such advice without thorough investigation.

6. By reason of the tremendous increase in the productivity of the worker which results under scientific management it has been accused of injuring the health of the worker. Scientific management not only recognizes the basic value of continuity of employment and longevity of the worker, but represents the only scientific attempt to increase production through the conservation of his health and effort. Although this may be contrary to popular conception, scientific management, nevertheless, obtains increased individual output, not by drive, but by the elimination of waste.

7. It is erroneous to assume that speed affects the health of the worker. Speed in itself is not injurious. Under scientific management it is the result of improving conditions of work which under ordinary management tend to contribute to his ill health. There are conditions under which operating at half the best possible speed is more fatiguing and more injurious to the worker's health than operating at the best possible speed under proper conditions. As a matter of fact, when conditions have been properly standardized and operations are taught by an adequate system of instruction, motions become reflex. It is well known that reflex motion is not only essential to the best possible speed, but requires a minimum of physical and mental exertion. We call your attention in this connection to the statement of the eminent psychologist, Professor William James. (*[1])

> "Habit simplifies the movements required to achieve a given result, makes them more accurate and diminishes fatigue."

8. The enormous saving of time effected under scientific management not only results in increased achievement, but also makes it possible and profitable to bring about that generally desirable end,—the shortening of hours. Greater achievement makes possible the payment of the higher wages of scientific management and at the same time the shortening of hours without increasing the cost of production. Fatigue is not only minimized by the reduction of the hours of work, but also by the conservation of effort while at work. Scientific management directly concerns itself with the elimination of all factors of fatigue. To quote from a recent work on fatigue study. (*[1])

> "Even where fatigue is not materially cut down during working hours, because measurement shows that the worker is not getting overfatigued, the general health is apt to improve because of greater regularity in habits of work, and because of better physical and mental habits, while doing the work. The path along this line is a continuous, never-ending, upward spiral. Fatigue is eliminated by establishing proper habits. Proper habits improve health. The improved health allows of more work with less fatigue, etc."

9. Under scientific management not only the physical condition of the worker in relation to his work, but also the physical conditions under which he works are made subjects of scientific study. A study of proper ventilation, lighting and sanitation results in a direct effect upon the quality and quantity of his output. The management must assume not only the responsibility for standardizing and perfecting these physical surroundings, but all other conditions relating to the work before it can proceed with the standardization of the job itself with a view toward scientifically setting a task for the worker. Standardization of tools and equipment by means of time study and other research methods of which the primary object is to eliminate unnecessary effort on the part of the worker—is an essential step in the increase of output. Materials also must be controlled by means of a proper routing system in order to insure an uninterrupted supply of work. By these means alone it is not uncommon under scientific management to effect an increase in output of 100 per cent or more, while lessening, rather than increasing the effort expended by the worker. Finally when time and motion study is applied to the job itself, the efforts of the worker are still further conserved by the elimination of wrong or unnecessary movements and by setting a definite, accomplishable task. No one realizes the amount of hopeless effort which is expended by the worker, or the amount of time and output which is lost because of neglect of these important factors under irresponsible management.

10. Speaking of scientific management, Josephine Goldmark, in her exhaustive study on "Fatigue and Efficiency" *[2]) says:

> "The new organization of work has brought also a new emphasis upon the workers' physical surroundings. All those physical inconveniences which waste human

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*[1] James' Psychology. Vol. 1. P. 102.

*[1] "Fatigue Study" by Frank S. and Lillian M. Gilbreth. Page 43. Pub. Sturgis & Walton Co., 1916.

*[2] Pages 201-202-203. Russell Sage Foundation.

strength and comfort and which are common rather than uncommon characteristics of our workshops,—such as bad air, bad light, overcrowding, dirt, and unsanitary conditions,—are all marks of inefficiency in the management. They are intolerable to the system which is based essentially on the observation and study of cause and effect. Where the ordinary management sees in the crudest so-called "welfare work" (better light, air, sanitation and comfort) merely concessions to the labor force, the engineer sees them as indispensable parts of the equipment. They are the mere commonplaces of efficiency, without which the accomplishment of predetermined tasks cannot be expected. . . . .

"Scientific management obtains its marvelous results not only by teaching the worker the best possible way of accomplishing his task with the least time and effort, but also by removing all possible external obstacles. The management has, in advance, perfected his equipment and sees that it is always in perfect order and that the worker is regularly supplied with material in perfect order and condition. . . . .

"One of the chief aims has been precisely to regulate 'the flow of work so that it shall be even and continuous'. . . . . Compared with such a regime, the crudity and chaos of ordinary systems stand out in glaring contrast. A revolution has been effected; a terrible waste has been checked, of that capital which alone is common and equal for all mortal beings: of time. . . . . Hitherto hours, days, and weeks of employment have been habitually lost to the workers through no fault of their own, but through the sheer incompetence of the management in performing its obligations and supplying materials and equipment fairly. No page in industry's history is more dreary and disheartening than the 'time lost' by competent and willing workers, waiting, unpaid, for employment which might be fairly regularized. Indeed, the daily delays and irregularities of work involve more than the direct loss of wage and earning capacity. They are more subtly interfused into the day's work; and the psychological gain which springs from the elimination of such daily annoyance and friction is undoubtedly an important factor in heightening working capacity under scientific management."

11. This brings out another important factor relating to the health of the worker. The psychological result which springs from the elimination of daily annoyance and friction is, as Miss Goldmark states, of vast importance in heightening working capacity, but is of even more significance in its effect upon the health of the worker. Scientific management replaces the old system of bosses with its petty annoyances and injustices by a system of functional foremen who are responsible for the development and training of the worker in all of his various functions. This functionalizing implies the assumption of direct responsibility by the management for all conditions and activities, including the important one of personal relationship. This, as Miss Goldmark has said, assures to the worker the "elimination of daily annoyance and friction," of paramount importance both to his good spirits and his good health. In the words of the late Frederick W. Taylor, "More than all . . . . close intimate coöperation and constant personal contact . . . . will tend to diminish friction and discontent." (*[1])

12. Mr. Gantt (*[2]) not only shows by graphic charts how the capacity of the workers is definitely increased under scientific management, but also points out a marked improvement in right habits of work, self-respect and good health. Too much stress cannot be laid upon the connection between mental and physical well-being. For this reason, alone, scientific management can be credited with being one of the most important forces contributing to the health of the worker.

13. Every one who has visited a plant where scientific management has been practiced for any length of time is immediately struck by the apparent good spirits and good health of the workers. If the individual records of the workers at the Clothcraft Shops of the Joseph & Feiss Company were investigated, they would reveal not only consistent evidence of good health, but also, in the majority of cases, a marked improvement. As evidence of the good effect of scientific management upon the health of the workers of this organization, attention is called to the comparative stability of its working force as shown above. Although a large majority of the workers are women, over one-third have been in the continuous employ of this organization for a period of five years or more. During the year of 1915 with an average standing payroll of seven hundred sixty-two, the average daily absences for all causes amounted to less than seven and one-tenth persons, or about nine-tenths of one per cent.

14. Scientific management has as its object the maximum of prosperity for both management and worker. This object is attained not only by safeguarding, but also by directly contributing to the health of the worker.

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*[1] "Principles of Scientific Management." Page 143. Harper Bros., New York.

*[2] Gantt, H. L. "Work, Wages and Profits." Engineering Soc. 1911.